

1982

Reconnaissance of Ground-Water Resources of Stone and Independence Counties, Arkansas

Albert E. Ogden

Southwest Texas State University

James R. Musgrove

University of Arkansas, Fayetteville

Lisa Milligan

University of Arkansas, Fayetteville

Follow this and additional works at: <http://scholarworks.uark.edu/jaas>



Part of the [Geology Commons](#), and the [Hydrology Commons](#)

Recommended Citation

Ogden, Albert E.; Musgrove, James R.; and Milligan, Lisa (1982) "Reconnaissance of Ground-Water Resources of Stone and Independence Counties, Arkansas," *Journal of the Arkansas Academy of Science*: Vol. 36 , Article 34.

Available at: <http://scholarworks.uark.edu/jaas/vol36/iss1/34>

This article is available for use under the Creative Commons license: Attribution-NoDerivatives 4.0 International (CC BY-ND 4.0). Users are able to read, download, copy, print, distribute, search, link to the full texts of these articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author.

This General Note is brought to you for free and open access by ScholarWorks@UARK. It has been accepted for inclusion in Journal of the Arkansas Academy of Science by an authorized editor of ScholarWorks@UARK. For more information, please contact scholar@uark.edu, ccmiddle@uark.edu.

General Notes

RECONNAISSANCE OF THE GROUND-WATER RESOURCES OF
STONE AND INDEPENDENCE COUNTIES, ARKANSAS

Ground water is utilized by most of the residents of Stone and Independence counties, Arkansas, but little is known about its occurrence and movement. An early listing of some ground-water wells in northern Arkansas was made by Branner (1973) without any hydrogeologic interpretations. A very generalized statement of ground-water resources in Arkansas was made by Baker (1955), and a reconnaissance of the deep (greater than 2000 feet in Stone and Independence counties) Roubidoux and Gasconade aquifers was made by Lamonds (1972). A recent study similar in scope to this one was published by Liebelt et al. (1980) for neighboring Baxter, Fulton, Izard, and Sharp counties. The purposes of the present study were to define the water-producing horizons in Stone and Independence Counties and to determine the range in depth and yield for each aquifer.

One hundred and sixty-six rural water wells have drillers' lithologic logs were accurately plotted on 7½ minute topographic maps with the aid of county plat books. The formation that produced water in each well was determined from detailed geologic maps made by the Arkansas Geologic Commission for the purpose of producing the geologic map of the state (Haley, 1976). Knowing the formation in which drilling began for each well, and combining this with the drillers' crude lithologic log and known average thickness of each formation (Caplain, 1954), it was possible to determine which formation formed the aquifer. The rocks are essentially horizontal throughout most of the study area except adjacent to normal faults. Most of the outcrops in Stone and Independence Counties range from Ordovician to Pennsylvanian in age. Wells producing from rocks and sediments younger than Pennsylvanian were not studied.

Six aquifer zones were found to be utilized in Stone and Izard Counties. The Table shows the range, median, and mean depth and yield for each aquifer zone. The median yield of the aquifer zones was essentially the same (5 to 8 gpm). It is surprising to note that the shale and siltstone units such as the Morrow (Bloyd-Hale undifferentiated), Fayetteville, and Ruddell-Moorefield aquifers produce as much water as the limestones (Pitkin and Boone-St. Joe) and sandstones (St. Peter-Everton). This is probably due to the great number of bedding planes and closely-spaced fractures found in the shales and siltstones. Unless conduits or fracture zones are intersected in limestones and tight sandstones, the yield will usually be low.

The Table indicates that the Morrow (Bloyd-Hale undifferentiated) is the most utilized aquifer zone. This is largely due to Morrow cropping out in a majority of the study area, but is also due to a greater population density found on Morrow rocks. Although the Boone-St. Joe aquifer crops out in much of the study area, the population density is low due to it being more rugged and because it is largely Natural Forest Service land. The St. Peter-Everton aquifer zone is the most productive, but crops out in only a small portion of the study area and is presently too deep in other areas to be economically feasible. Therefore, the ground water sources of these counties have just begun to be utilized with much left for future growth.

A preliminary method of determining the geologic controls on yield was made by using the Spearman Rank Correlation Coefficient statistical test (Siegel, 1956) to compare well depth, well yield, depth to bedrock (regolith thickness), depth to the water table, and piezometric surface level of each aquifer. This information was provided on the drillers' lithologic logs. For each of the aquifers except the Boone-St. Joe limestone, regolith thickness was found to be directly related ($\alpha = 0.1$) to well yield and inversely related to depth to the water table. The regolith is usually thickest along fracture zones, where weathering proceeds most rapidly. This explains why higher yields are found where the regolith is thickest. Also, thick regolith is expected in valleys where the water table is close to the surface. Likewise, valleys commonly form along fracture zones. Well yield was also found to be inversely related to depth which can be explained by the closing of fractures with depth due to increase lithostatic pressure. Another possible explanation is simply that a well that is located on fractured rock will obtain water at a shallow depth, whereas a well not located on a fracture will probably be a low producer no matter how far the well is drilled.

One conclusion that can be drawn from the range in yield (Table) is that some wells in each of the aquifers can have very high yields with respect to the mean. Future studies should look closely at the geologic conditions around such wells so that high yield wells can be better located.

LITERATURE CITED

- BAKER, R. C. 1955. Arkansas ground-water resources. Arkansas Geologic Commission, Water Resources Cir. No. F, 16p.
- BRANNER, G. F. 1937. List of Arkansas water wells. Ark. Geol. Comm., Inf. Cir. 11, 142p.
- CAPLAN, W. M. 1954. Subsurface geology and related oil and gas possibilities of NE Arkansas. Ark. Geol. Comm., Bull. 20, 17 plates, 124p.
- HALEY, B. R. 1976. Geologic Map of Arkansas. Arkansas Geologic Commission, Little Rock, Arkansas.
- LAMONDS, A. G. 1972. Water resources reconnaissance of the Ozark plateaus Province, Northern Ark. U.S.G.S. Hydro. Inv. Atals HA-383, 2 plates.
- LIEBELT, M., G. LUNDY, and A. E. OGDEN. 1980. A preliminary investigation of the ground-water resources of Baxter, Fulton, Izard, and Sharp counties, Arkansas. Proc. Ark. Acad. of Sci. 34:72-74.
- SIEGEL, S. 1956. Nonparametric statistics. McGraw-Hill Inc., New York, 312p.

Table. Range, median, and mean of the depth and yield of aquifers in the study area.

AQUIFER	NUMBER OF WELLS	DEPTH (ft)			YIELD (gpm)		
		RANGE	MEDIAN	MEAN	RANGE	MEDIAN	MEAN
BOYD-HALE (UNDIFF)	77	52-450	110	90	1-75	5	7
PITKIN	7	40-155	88	82	0.5-50	6	5
FAYETTEVILLE-BATESVILLE	37	32-195	68	76	0.5-30	6	10
RUDDELL-MOOREFIELD	26	57-250	105	94	3-10	5	5
BOONE-ST. JOE	15	90-375	147	138	1-13	5	6
ST. PETER-EVERTON	4	39-500	342	312	0.5-15	8	7

ALBERT E. OGDEN, Assistant Director, Edwards Aquifer Research and Data Center, Southwest Texas State University, San Marcos, Texas 78666 and JAMES R. MUSGROVE and LISA MILLIGAN, Department of Geology, University of Arkansas, Fayetteville, Arkansas 72701.